Example of collaborative problem solving (CPS)

The Daemon Machine

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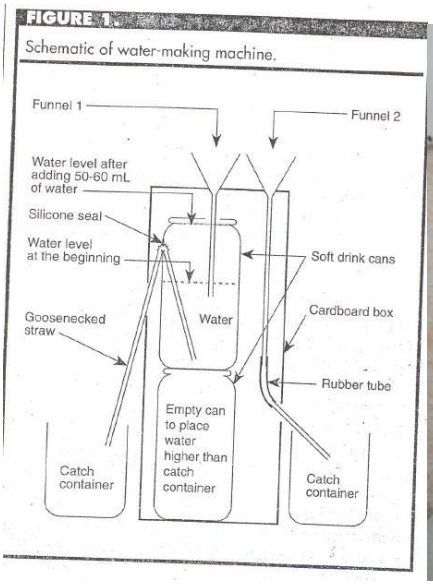
Description.

This activity is based upon an article of Saouma Boujade from the American University of Beirut (Lebanon) entitled ***Demonstrating the nature of science***[1]. The principal objective of the activity is that science teachers of high school level understand the nature of theory choice working in teams and under incomplete knowledge (uncertainty). To clarify this we describe the whole activity step by step below:

Step 1: We form teams of no more than five members each one

Step 2: We present them the water machine that functions as described by Boujade (Images 1 and 2). We call it "Daemon Machine" to increase the mysterious function of the machine, since it serves as a "black box" which means that they can see how it works but not the internal mechanism by which it works.



Images 1 & 2

[1] The science teacher, april 1995, pages 46-49

Step 3: Once all the teams have seen the "Daemon Machine" functioning, they are asked to discuss and figure out how they think the internal mechanism is arranged to function the way it was shown. As I know that they, as individuals could have different opinions concerning this issue I asked them to discuss for about 20 to 30 minutes their arguments with their team peers. After that I give them a big piece of paper to draw a model agreed by consensus of the internal mechanism of the "Daemon machine".

Step 4: After they have reached an agreement as a team about the model they think is the more accurate to describe the functioning of the machine, they make a draw and present it in front of all their peers in a public exhibition of their drawing and explain, through arguments why they think their model explains the function of the artifact. They are encouraged to give arguments based upon physical laws and principles solely. (Image 3)

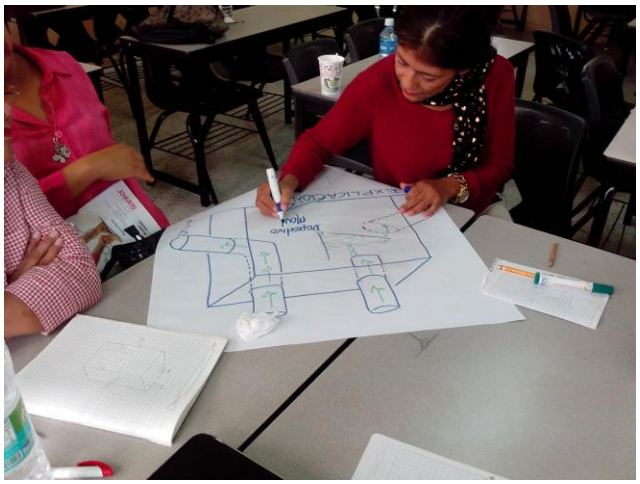


Image 3

Step 5: Once all the teams have presented their models, I give them some materials to build and test their hypotheses (figure 4). They have to build their own Daemon Machines upon the models they presented early.

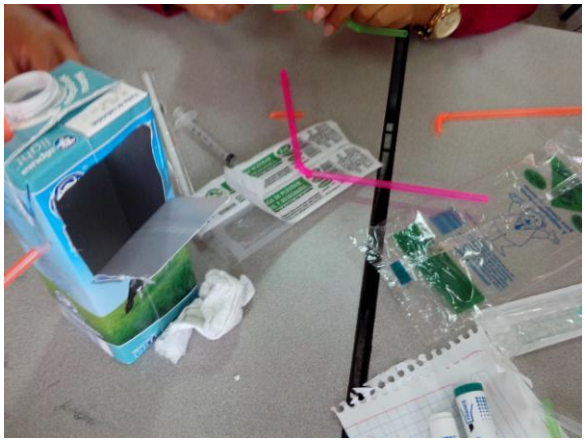


Image 4

Step 6: Finally every team present their machine whether it function or not as shown at the beginning of the class. After this we discuss on how they choose their models, if there was disagreement and how they solve it to present a single model, and the nature of theory choice when working in teams and with many variables unknown.

a. Describe a behavior of an individual that you think demonstrates a high level of ability on one or more skills in the CPS.

As all the teams formed to work in the activity described above work under uncertainty since they can only see the function of the machine but not its internal mechanism they usually show several skills as the steps 3 to 6 take place. For instance many of the individuals have to **interact** with their partners in order to discuss how they think a model could explain the function of the machine. They need to **negotiate** with those that have alternative models, since I ask every team to present only one model per team. Every team has to explore **transactive memory** for they have to analyze arguments of different members of the team and sow pros and cons of their ideas. Also I have seen that through this activity almost each member of every team gets involved in **problem analysis** and **Plans a strategy based on a generalized understanding of cause and effect** for they have to figure out how could a model explain and function as the artifact shown.

b. Describe another example of a behavior that you think demonstrates low level of ability of an individual on one or more skills in the CPS framework.

Something that I have seen with this activity and that demonstrates a low level of ability is that many individuals get stuck when its model does not work at the first attempt. This shows that many of them do not manage **Systematicity** in a regular basis for many of the individuals make a random trial and error based upon only a few possibilities (generally only one). This situation is related also with a low skill in **reflects and monitors** since they generally test their hypothesis but do not have the ability to change their hypothesis as the circumstances change nor adapt their hypothesis as their original theory fails.

Conclusion

I think this activity stimulates Collaborative Problem Solving as well as it shows participants how it works a team in science. However some improvements have to take place during the activity.